DOCUMENT RESUME

ED 232 577 HE 016 501

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TITLE Institutional Research and End-User Computing: The Development of an Information Center. AIR 1983 Annual Forum Paper.
PUB DATE May 83
NOTE 26p.; Paper presented at the Annual Forum of the Association for Institutional Research (23rd, Toronto, Ontario, May 23-26, 1983).
PUB TYPE Viewpoints (120) -- Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Case Studies; *College Administration; *Computer Oriented Programs; Databases; Decision Making; Higher Education; *Information Centers; Information Needs; *Institutional Research; *Management Information Systems; *Program Development; Program Implementation
IDENTIFIERS *AIR Forum

ABSTRACT

The role of institutional research in the creation and operation of an information center is discussed, along with the ways in which the spread of information centers within higher education is likely to influence the future development of institutional research. Forces leading to the emergence of information centers are advances in computer hardware and software, and the emergence of the end-users (i.e., people who make productive use of the computer). To insure that the use of computer resources serves organizational objectives without constricting the flexibility of user independence, two components are needed: a systems review group to oversee and coordinate the growth of computer use, and information system development. The prerequisites for information center development are: the recognition of need, database considerations, a pilot test, definition of roles, and budget commitment and perceived benefits. One institutions's experiences in linking the institutional research office to performing information center functions are described. It is suggested that rather than providing information in a formal report, institutional researchers will increasingly assist decision makers in retrieving, analyzing, and reporting needed information directly via their own computer. (SW)

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INSTITUTIONAL RESEARCH AND END-USER COMPUTING: THE DEVELOPMENT OF AN INFORMATION CENTER

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THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twenty-Third Annual Forum of the Association for Institutional Research held at the Sheraton Centre in Toronto, Ontario, May 23-26, 1983. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
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ABSTRACT

An information center brings together fourth generation computer software, expertise in the use of this software, and the end-user in an effort to increase the productivity of data and information processing. This paper shares guidelines and experiences, drawn from the literature and a case study, for the development of an information center. The focus of the paper is on the role of institutional research in the creation and operation of such a center, and the ways in which the spread of information centers within higher education are likely to influence the future development of institutional research.

INTRODUCTION

The concept of an "information center" is relatively new to the fields of data and information processing. It refers to a location which brings together fourth generation computer software, expertise in the use of this software, and the end-user. Its function is to improve the information processing productivity of college staff, their offices, and the college as a whole. An information center provides one mechanism for "integrating human resources and technology."

Advances in computer software over the past ten years have made the development of information centers a possibility. This software allows end-users to create or access existing data bases without the lengthy and technical processes involved in traditional programming techniques, such as with COBOL.

The development of information centers within higher education will have a significant impact on the future role and direction of institutional research. Institutional researchers should be involved in the creation of an information center since they have the expertise to help users in transforming operational data into relevant management information. Institutional researchers need to be involved if they are to maintain and

enhance their role in assisting decision-makers.

The purpose of this paper is to chart one possible future direction for the evolution of institutional research. It is argued that, due to the environment facing higher education in the 1980s, some form of evolution is required if institutional research is to remain a viable asset for decision-makers in our colleges and universities. Although the 1982 Association for Institutional Research Forum stressed the political nature of this evolution, such a role may not be feasible or desirable at many institutions. An alternative, but not mutually exclusive role that institutional research can move toward is to assist decision-makers in employing modern computer technology to find, process, and distribute information. An information center provides a means for achieving this objective.

FORCES LEADING TO THE EMERGENCE OF INFORMATION CENTERS

This paper draws on two separate but interrelated themes within the literature on data processing and institutional research. First, the concept of an information center springs from the data processing literature on fourth generation software (Martin, 1982). On the other hand, institutional researchers have focused on the use of fourth generation software in creating decision support systems (Updegrove, 1981). A recent

issue of New Directions for Institutional Research focuses on managing the new information technology (Sheehan, 1982). The forces leading to the emergence of information centers are (1) advances in computer hardware and software, and (2) the end-user movement.

Advances in Computer Hardware and Software

The fact that computer hardware has become more powerful and less expensive has tended to hide the strategic advances made in computer software. Today's easy-to-use fourth generation software is changing drastically the way data can be processed. In order to provide a perspective for today's fourth generation software, the first three generations are reviewed.

First generation software was the mathematician's world of BOOLEAN ALGEBRA. The binary logic of each computer's machine language was and still is used to control the computer. This machine language was simplified by creating assembly language codes, thus making it easier for mathematicians or programmers to manipulate the machine language. These second generation assembly languages were further simplified by creating the English language commands of FORTRAN, COBOL, and BASIC which translate into assembly language and machine language. These third generation software languages are usable by

non-mathematicians; however, users still need to tell the computer how to do what is wanted. The emerging fourth generation languages allow the everyday end-user to tell the computer "what to do" without struggling with "how to do it." Specialized languages, like VISICALC, SPSS, and Word Star are examples within accounting, statistics, and word processing.

End User Movement

'End users' are people who make productive uses of the computer; now sometimes developed by themselves. The data processing literature has many stories of the successes that end-users have had in developing their own information systems. This is because the advent of microcomputers, fourth generation software, and distributed systems has decentralized computer use. Instead of relying on a centralized data processing staff, many users are creating their own systems. Although there are many benefits to be derived from this expansion of computer use, it does create problems in terms of the comparability, integrity, redundancy, security and transmission of data. This situation, in turn, can lead to problems in furnishing information to upper management when it has to be consolidated from separate and incompatible systems.

FACILITATING IMPROVED PRODUCTIVITY

To insure that the use of computer resources serves organizational objectives without constricting the flexibility of user independence, a two-prong approach is suggested. First, a systems review group is needed to oversee and coordinate the growth of computer use. This group must develop a strategic plan for computer resources, must review hardware and software purchases to insure compatability, and must set priorities in application development (Mann, 1982; pp 36-39). Thus, this systems review group can act as a mechanism to resolve the management problems that arise with proliferation and decentralization of data processing. The second part of this approach involves the formation of an information center.

The information center becomes the mechanism by which expansion of computer use and decentralization can be implemented in an orderly fashion. An information center provides the resources for computer users to optimize their efforts. This would include training and guidance with respect to existing information and available computer resources. It includes educating the users with regard to system development guidelines and documentation standards as they decide to develop their own systems. Information center staff can work with end-users in developing their ideas into detailed

specifications for which a prototype system can be created. Information center staff could also develop some of the strategic information systems needed to support upper management's decision making (O'Connell, 1982; Murry, 1983; Rhodes, 1983).

An information center serves two separate but interrelated data processing needs. First, it serves as a supplement to operational systems. For example, our college has a COBOL based on-line student registration system. However, because of the large backlog of system development projects, there was no data processing system for the admission selection process for limited enrollment programs (i.e., nursing, automotive, electronic engineering, etc.). Since such a system could not be accomodated within the existing application development resources, the information center approach was an alternative choice for developing and implementing the system. Other offices have already, or are considering the development of special information systems using their staff and the improved computer technology.

Second, third generation software systems (such as COBOL-based systems) are usually very strong in meeting high volume transactional operational needs but weak in terms of management decision support. That is, ad hoc query and reporting is

almost non-existent in a truly timely manner, yet very possible. An information center provides the staff, hardware/software resources, training, and technical support to meet part of this strategic need which has traditionally been served by institutional research offices.

PREREQUISITES FOR INFORMATION CENTER DEVELOPMENT

The establishment of an information center requires short term reallocation of resources and long term changes in the way people approach the use of computers. The prerequisites for information center development are (1) the recognition of need, (2) data base considerations, (3) a pilot test, (4) a definition of roles, and (5) budget commitments from identified benefits.

Recognition of Need

As with any major organizational change, support from upper management is critical. Further, this support is not limited to resource allocation and personnel shifts. Since a major goal of an information center is to advance decision support systems, management must become directly involved so that the resulting information products reflect their needs. This does not imply that management must know exactly what information

will be required to assist in future decisions. If this were the case, they would probably not need the information in the first place. What managers should do is develop a conceptual view of institutional processes, out of which decision requirements grow, and then guide the information system development so that it will reflect these institutional proceses (Bryce, 1983). Such system design methodology requires time, patience, and firmness of leadership; and it is in this endeaver that the true test of management support lies.

Data Base Considerations

For fourth generation software tools to be effectively used, a sound data base must exist and be accessible (Martin, 1982; pp. 265-286). Information needs of upper management are often not met in a timely manner due to the fact that the data does not exist in the proper form within the data base or cannot be easily accessed. Thus, a major technical prerequisite to the emergence of a viable information center is the existence of a rational data base. It is also important that the data base be understood by the users - at least at the conceptual level. This is necessary, since most user applications will be derived from the existing data base, or integrated into the data base. This data base is an institutional resource which must be nurtured and understood in order to optimize its value.

A Pilot Test

A pilot test is recommended to demonstrate the feasibility and cost effectiveness of an information center to key decision-makers and the user community.

James Martin (1982; pp. 161-177) describes the case of Sante Fe Industries, Inc. in which a production control system was developed by shop floor personnel using the software MAPPER developed by Sperry Univac. The systems were developed independent of data processing, since they had projected years for development, and eventually involved several hundred users. Eventually data processing accepted the MAPPER based system. An interface was developed between data processing's IBM and the Sperry Univac used by manufacturing.

The situation that arose at Santa Fe Industries is not unusual. Of course, all of this could have been coordinated and centrally planned in the first place. However, because of resistance to change and other organizational problems, the Sante Fe experience is likely to be repeated before coordinated efforts become more common. For other examples, see O'Connell (1982), Snyders (1982), Murry (1983), Rhodes (1983), and Kull (1983).

Definition of Roles

Once the value of fourth generation software tools and the concept of an information center has been accepted, it is important to define the changed roles played by users, computer services, and non-data processing managers. The various approaches that can be used to organize the functions of an information center are discussed in the following section. Regardless of the scheme selected, however, there will have to be a change in roles. The most critical change occurs with regard to the relationships between non-data processing managers and the design of the information system. But this is not the same as the traditional development of a management information system, as perceived in the 1970s. That approach assumed that non-data processing managers could identify all their information needs in detail. When the unexpected occurred and information needs changed, the "hardwired" information system was not able to respond in adequate fashion. As a result, the goals of a management information system, which had become confused with the means, fell into disfavor.

The goals of a management information system are now more within grasp. A combination of good system design methodology, fourth generation software, and management involvement can

result in the realization of flexible decision support systems capable of responding to changing conditions. For this to occur however, the function of an information center must be kept separate from data processing. The highest priority of data processing must be quality control or stated differently: data integrity and operational efficiency. The priority for the information center must be decision support systems which transform data into usable information. For this to occur, the information center should be responsible to upper management and have a close liaison with data processing, especially in data base planning.

The commitment and involvement of management must provide the leadership required to overcome natural resistance to change within an organization. User independence should be encouraged but also controlled; thus, contributing to the growth and quality of the institution's information resources.

Budget Commitment and Perceived Benefits

The establishment of an information center requires an analysis of the cost versus the benefits to be derived. The primary cost item for an information center is personnel. This includes center staff as well as the staff time from other offices. Whereas information center staff cost is fixed, the

cost to the user community is primarily upfront in the form of training time. The cost of information center staff could be minimized by re-focusing existing staff with similar responsibilities such as institutional research or computer services. This has basically been the approach taken at our college. The refocusing was made possible since the areas first to reap a productivity increase from fourth generation software were institutional research and computer services.

The benefits of an information center are both quantitative and qualitative. Quantitative benefits are measured primarily in terms of productivity, which is derived from the use of fourth generation software. With users doing more of their own data processing, and with applications taking less time to develop, maintain and document, an information center can help to constrain data processing costs while getting greater output (Kull, 1983). Qualitative benefits include an improvement in the quality of information available to assist decision-making. Fourth generation software allows data to be manipulated with speed and flexibility. As a result, managers are able to derive more and better information from the data base. This in turn should lead to better decisions and further cost savings.

ALTERNATIVE APPROACHES TO STARTING AN INFORMATION CENTER

At different institutions, depending on the abilities, sensitivity, and leadership of various offices, alternative approaches for starting an information center can be taken. While the centralized data processing staff, the Computer Science faculty, and the Institutional Research staff should all play a role, someone must take the lead. Perhaps a newly created office is the answer; however, today's financial environment may suggest that an existing office be given the responsibility of working with the end-users to optimize the potential of fourth generation software. Whichever office is given this responsibility, it should employ the existing resources from the other offices. For example, Computer Science faculty could guide the development of end-user training activities; Institutional Research staff could help the end-user identify appropriate data sources, data definitions, analysis methods, and reporting techniques; and Data Processing staff could help the end-user with a particular computer's operating system, with data base planning, and with fitting into a network where information resources can be shared.

Institutional research offices are at a crossroads as the impact of this new information technology is felt. Three alternatives exist for institutional research according to Hample (1983):

... (1) Institutional research will become obsolete

... (2) Institutional research could save campuses from "Information Anarchy", and

... (3) Institutional research can guide information system development.

Institutional Research can take its decision support role a step further by providing leadership towards an information center for end-users as well as towards systems review for all new or modified systems. Information system development needs policy, procedures, and leadership.

ONE COLLEGE's EXPERIENCES

Current Status

In order to illustrate the above discussion, one institution's experiences are used to describe the evolution of an Institutional research office toward performing information center functions.

At the college in question, the COBOL based financial system did not include procedures for budget development. Thus, each year the college's budget was put together manually. Further, the budget aggregated data to the division level (i.e., the Allied Health Division) and all program detail data was subsumed (i.e., Nursing, Dental Hygiene, etc.). The process is complicated by the fact that many individuals are assigned to more than one program and/or division. Thus, the process was both tedious and complicated. Yet another problem is that it was time-consuming if not impractical to make "what if" calculations.

The backlog in data processing applications made resolution of these problems years away. Thus, Institutional Research, the Office of Instruction and the Business Office combined efforts to computerize the budget building process using a fourth generation software language (Stevenson and Walleri, 1982). The language is INFO, a relational data base management system developed by HENCO, Inc. Because of the user friendly nature and flexibility of INFO, the college's budget system was completely computerized within a few months.

The success of the budget project soon led to the expansion of INFO within other offices. The Financial Aid Office learned of INFO and computerized a student financial aid application

record system. This not only improved the effectiveness of the Financial Aid Office, but also eliminated another system from Computer Services' application backlog.

Other applications have included an equipment inventory system for Plant Services, a tuition revenue projection model in the Business Office, and an admission application system for limited entry programs for the Office of Admissions and Records. A few offices have begun to use INFO to prepare various operational reports once prepared by hand.

During this process Institutional Research has remained the major support unit. In some cases this has included design, programming, training of users, documentation and maintenance. In cases where the users have learned to do their own programming, Institutional Research has provided training, technical assistance and acted as liason to Computer Services.

Finally, Institutional Research, through its expertise in using INFO, has been able to respond more effectively to ad hoc requests for information from upper management. For example, using the INFO budget data base, reports were generated for total direct cost per student FTE and for supplies and equipment cost per FTE. These reports were then used to assist in making budget decisions within an institutional evaluation

process (Stevenson and Walleri, 1980; 1982).

The Future

This college is moving toward the adoption of a relational data base management system using fourth generation software for query, reporting, and application development. To meet increasing need for data processing services, the college is also developing a distributed network of minicomputers. Within this environment, office automation and electronic mail software can be installed to increase office productivity even more. A software library has been established to allow for specialized analysis of data to meet specific information needs. This library includes statistical routines and a financial modeling language to compliment the query and reporting capabilities available.

Within this environment, an information center can assist end-users in maximizing the benefits to be derived from the growing array of hardware and software. The ability to use computers will increasingly become a necessity within society in general and higher education administration in particular. Some mechanism must be found to facilitate and guide this advance within our institutions. An information center represents a logical and efficient means for making this

transition.

IMPLICATIONS

The implications of an information center should be viewed from an institution wide perspective as well as with regard to institutional research. The primary benefit of an information center for a college or university is that it will improve the information available to decision-makers while also helping to constrain data processing and other administrative costs by making people more productive.

The role of institutional research is likely to undergo a shift in emphasis. That is, rather than providing information in a formal report format, institutional researchers will more likely assist decision-makers, or their support staff, in retrieving, analyzing, and reporting needed information directly via their own computer. This should allow institutional reseachers to concentrate on the more strategic and sophisticated information needs.

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